VEGETATION SAMPLING AND CLASSIFICATION

Introduction

This report presents the results of the vegetation classification portion of the USGS-NPS Vegetation Mapping Program at Mount Rushmore National Memorial. The major goal of this portion of the project was to classify and describe all plant communities found within the study area. In addition, vegetation data were used by the photointerpreter to determine relationships between signatures on aerial photos and vegetation types on the ground, and in some cases, to correlate habitat characteristics and vegetation types for predictive modeling. Sampling strategy and field methods are described for vegetation sampling. The vegetation classification, field key to the vegetation types, and descriptions of each type are also included. As a supplement to this report, the raw plot data are included as original field forms and in electronic form in the PLOTS database (a Microsoft Access database).

Methods

The methods used for the sampling and analysis of vegetation data and the development of the classification generally followed the standards outlined in the Field Methods for Vegetation Mapping document produced for this project. This process began with the development of a preliminary list of vegetation types from the National Vegetation Classification System (NVCS) that were thought to have a high likelihood of being in the mapping area. The list was prepared by literature review, including previous vegetation classifications of the Memorial, and contacting knowledgeable experts. Due to the small size of the mapping area, sampling occurred across the entire mapping area. Most samples were taken from within the boundaries of the Memorial.

Nineteen plots were collected in late July and August of 1996. The field team attempted to place plots in each of the vegetation types on the preliminary list that they could find. In addition, vegetation types that were encountered in the field which appeared distinct from any on the preliminary list were sampled. Plots were subjectively placed, generally in vegetation that was representative of an area of relatively homogeneous vegetation which covered more than 1/2 ha (the minimum mapping unit). Thus, ecotones and small patches were avoided. However, in cases where several vegetation types regularly occurred in mosaics of small stands, it was necessary to use multiple plots and sample smaller patches.

Number of plots and plot size varied by community. The number of plots depended on the areal extent of the community on Mount Rushmore NM, i.e. more widespread communities had more plots than rarer ones. Forest and woodland communities were sampled with 20 x 20 meter plots while herbaceous communities were sampled with 10 x 10 meter plots. In some instances rectangular plots of the same area were used (i.e. 10 x 40 m or 5 x 20 m) in linear or narrow polygons.

In late May and June of 1997, after a preliminary vegetation map had been prepared by the photointerpreter, a map validation step was performed in which further data were collected to obtain more information on the vegetation types and to better correlate the vegetation with the signatures on the aerial photographs. Sampling was conducted at points selected by the photointerpreter based on a stratified random design in which more extensive vegetation types were allocated more points. This resulted in the collection of 46 observation points. At each point, the dominant species in each vegetation stratum were recorded with an estimated cover class. These extra points gave a better understanding of the variation within vegetation types and allowed sampling of two types that had not been found in the previous field season.

The final vegetation classification and descriptions were produced using plots, observation points, and the experience of the field team. Field personnel organized the plots and observation points into groups based on vegetation structure and composition. The number of plots ranged from 0-5 per type and the number of observation points ranged from 0-11 per type. Black Hills Rock Outcrop Sparse Vegetation was not sampled with either plots or observation points because it was easily distinguished from surrounding vegetation types. Quantitative analyses were performed to compare to the subjective classification. Average cover of each species and vegetation stratum were computed. Only the plots were used for quantitative analysis because of the more detailed information collected for them. They were analyzed using an ordination technique, Detrended Correspondence Analysis (DCA), and a clustering algorithm, Unweighted Pair-Group Method Using Arithmetic Means (UPGMA). Because there were few plots per type and the locations of the plots were chosen to emphasize the variation within a vegetation type, there was substantial variation within each type. These factors lessened the utility of the numerical analyses. Thus, the results of the numerical analyses were not used to derive the classification, but were compared to the subjective classification and any discrepancies in plot placement were examined.

Results

The classification of the vegetation of Mount Rushmore NM resulted in nine types being defined, including two forest types, four woodland types, two herbaceous types, and one sparsely vegetated type.

The vegetation types described in this report do not necessarily correspond to units on the final vegetation map, for several reasons. In some cases, two or more plant communities distinguishable on the ground could not be distinguished in aerial photographs, nor predicted based on habitat characteristics. In this type of situation, the photointerpreter lumped multiple plant communities into a single map unit, labeled as a complex. In other cases, multiple communities occur as mosaics of small distinct stands which vary over too fine a scale to be mapped individually. These are mapped as mosaics.

In classifying vegetation, we attempt to recognize distinctive assemblages of plant species that occur repeatedly in appropriate habitat conditions. These plant communities become the basic mapping units in preparing vegetation maps. In some cases, the concept of a discrete assemblage of plants characteristic of a given habitat works very well. For example, in the Black Hills it is easy to correctly predict associated species and habitat characteristics for stands of paper birch and beaked hazel. In other cases, it can be very difficult to subdivide vegetation into consistent, repeating assemblages of species. Much of the ponderosa pine vegetation in the Black Hills presents this problem to some degree. Understory composition often is too variable or varies over too fine a scale to easily define discrete communities,

especially using remotely sensed data. Boundaries are not easily recognized. Types grade into other types. The extensive disturbance history of ponderosa pine stands in the Black Hills makes this picture even more difficult to interpret.

In the Black Hills, many investigators have reported difficulties in classifying ponderosa pine vegetation. In our study, we encountered the same problems. Pine stands at environmental extremes (most xeric, most mesic) tended to be fairly consistent in species composition. *Pinus ponderosa / Schizachyrium scoparium* Wooded Herbaceous Vegetation (dry slopes, often south-facing) and *Pinus ponderosa / Physocarpus monogynus* Forest (northerly slopes) are two good examples. In contrast, stands found on intermediate sites were often problematic due to variable understory composition.

The classification of Mount Rushmore NM follows. A field key and descriptions for each of the types are included in later sections of this report.

Classification

"*" indicates a new Formation in the National Vegetation Classification System.

1. FOREST
   - I.B Deciduous forest
     - I.B.2 Cold-deciduous forest
       - I.B.2.N Natural/semi-natural
         - I.B.2.N.a. Lowland or submontane cold-deciduous forest
           QUERCUS MACROCARPA FOREST ALLIANCE
           Quercus macrocarpa / Ostyra virginiana Forest
         - I.B.2.N.b Montane or boreal cold deciduous forest
           BETULA PAPYRIFERA FOREST ALLIANCE
           Betula papyrifera / Corylus cornuta Forest

II. WOODLAND
   - II.A. Evergreen forest
     - II.A.4. Temperate or subpolar needle-leaved evergreen woodland
       - II.A.4.N Natural/semi-natural
         - II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
           PINUS PONDEROSA WOODLAND ALLIANCE
           Pinus ponderosa / Arctostaphylos uva-ursi Woodland
           Pinus ponderosa / Juniperus communis Woodland
           Pinus ponderosa / Oryzopsis asperifolia Woodland
           Pinus ponderosa / Quercus macrocarpa Woodland

V. HERBACEOUS VEGETATION
V.A. Perennial graminoid vegetation
V.A.5. Temperate or subpolar grassland
V.A.5.N Natural/semi-natural
V.A.5.N.j. Temporarily flooded temperate or subpolar grassland
CAREX LANUGINOSA TEMPORARILY FLOODED HERBACEOUS ALLIANCE
Carex lanuginosa - *Calamagrostis stricta* Herbaceous Vegetation

V.A.6 Temperate or subpolar grassland witha sparse tree layer
V.A.6.N Natural/semi-natural
V.A.6.N.f. Medium-tall temperate or subpolar grassland with a sparse needled-leaved evergreen or mixed tree layer
PINUS PONDEROSA WOODED MEDIUM-TALL HERBACEOUS ALLIANCE
Pinus ponderosa / Schizachyrium scoparium Wooded Herbaceous Vegetation

VII. SPARSE VEGETATION
VII.A. Consolidated rock sparse vegetation
VII.A.1 Sparsely vegetated cliffs
VII.A.1.N Natural/semi-natural
VII.A.1.N.a. Cliffs with sparse vascular vegetation
ROCK OUTCROP/BUTTE SPARSE VEGETATION
Black Hills Rock Outcrop Sparse Vegetation

Conclusion

The vegetation of Mount Rushmore NM was classified using the techniques established for the NPS/BRD Vegetation Mapping Program. All of the vegetation types fit within existing associations in the NVCS. Due to extensive disturbance and regional variation, some of the vegetation at Mount Rushmore NM did not closely match the more general, national description of the community into which it was placed.

Several recommendations for future mapping projects have flowed from the experience gained mapping Mount Rushmore NM. It is recommended that future mapping projects begin fieldwork with a reconnaissance step involving observation point data collection from a large number of points. This type of sampling goes relatively fast and would allow the project investigators to identify plant communities within the study area and to get some feel for variation within each type. After a preliminary classification is in hand, representative stands could be selected for more detailed vegetation plots. Data collected for observation points would also supplement vegetation plot data in preparing community descriptions. This

approach is most suited to small parks where regaining access to an area is not especially time-consuming or difficult. In larger parks or those with remote areas, it would still be beneficial to collect observation points from the same area and at the same time as plots are being collected.

Communication between the field ecologists and the photointerpreters/mappers is vital for a successful project. One step that can help this is to begin field work with aerial photos with preliminary vegetation polygons delineated. This helps the ecologists direct their sampling and the process of polygon delineation often generates questions relating to vegetation classification which the field team can investigate during vegetation sampling instead of after the field season.

Contributors

The following individuals contributed to this report:

Hollis Marriott
Wyoming Nature Conservancy
655 N. Cedar St.
Laramie, WY 82072

Amanda McAdams
Diane Stutzman
Black Hills Heritage Inventory
c/o Black Hills National Forest,
Supervisor's Office
RR2, Box 200
Custer, SD 57730

Jim Drake
The Nature Conservancy
Midwest Regional Office
1313 Fifth St. SE, Suite 314
Minneapolis, MN 55414

Dennis Grossman
The Nature Conservancy
International Headquarters
1815 N. Lynn St.
Arlington, VA 22209